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Northern Circumpolar Crustose Lichens New to Japan

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Sixteen crustose lichens are reported as new to Japan: *Anisomeridium nyssaegenum, Arthonia spadicea, A. vinosa, Chrysothrix candelaris, Cliostomum griffithii, Enterographa zonata, Lopadium disciforme, Maronea constans, Opegrapha gyrocarpa, O. varia, Pachyphiale carneola, P. fagicola, Porina mammillosa, Scoliciosporum chlorococcum, S. umbrinum and Strangospora moriformis*. These species all have wide ranges of distribution and have earlier been reported from Europe and North America. Several other crustose species presently assumed to be restricted to one or both of these continents will most probably be found to occur throughout the northern Hemisphere and thus also in Japan and in the Asian part of Russia. Short morphological descriptions based on the Japanese collections are provided, as well as notes on distribution, Japanese habitats and other characteristics.

In the course of lichenological field trips to northern, central and southern Honshu as well as Kyushu in 1994, numerous crustose lichens (mainly corticolous) were collected. Habitats from coastal lowland to alpine forests, and one locality above the timber line were visited. We have also studied collections by E. Sado from northwestern Hokkaido. As a result of these studies, sixteen crustose species are here reported as new to Japan. The presence of three further crustose species, *Japewia tornoënsis, Lecidea erythrophaea* and *Porina chlorotica* in Japan is confirmed. All of these species can now be shown to have an essentially northern circumpolar distribution, though a majority had previously been assumed to be restricted to North America and Europe. Several other crustose species which until now have been reported from the arctic, boreal and/or temperate zones in Europe and/or North America will most probably be found to occur in appropriate habitats throughout the northern Hemisphere, and thus also in Japan and in the Asian part of Russia. This is perhaps not surprising, given that the land masses of the temperate and boreal zones form an almost coherent geographical area in which climate conditions are in many regards similar. Other species which occur in at least Europe and only much earlier reported from Japan (e.g., Nylander 1890), urgently need to be re-evaluated in light of the taxonomic and nomenclatural advances made in recent decades. It should be noted that several species for which no Japanese (or Asian) distribution records are given in Purvis et al. (1992) have actually previously been reported from Japan. Excluded from this paper are several still undetermined species, all isidiate species, all sorediate species (except *Enterographa zonata* and *Opegrapha gyrocarpa*), some undescribed species, and various additional species which will be reported by other authors.

Almquist's Localities in Mount Fuji

From September 25 to October 3, 1879, Dr. E. Almquist climbed Mount Fuji (Nylander 1890) and collected many lichens, several of which have not been reported since, or are not reported from any other locality in Japan. No definite information is given by Nylander (1890) about which of the approximately five existing trails E. Almquist followed to reach the summit. However, as shown below, he must have followed the main trail on the southwest slope of the mountain which is the only trail which do not have a specific name. Three localities and their altitudes on Mount Fuji are mentioned in the next (Nylander 1890, p. 1–2). E. Almquist started in Mourayama (alt. c. 200 m) which is the name of a "mura", i.e., a village and its surroundings. This settlement is located at about 35°14'N, 138°40'E, and is 4.5 km northeast of the town of Fujinomiya. The second locality is Ouma-gayeshi (alt. 1000–1500 m) which is not, however, the name of a village, but roughly means "where to leave the horses". Points bearing this name are located on all trails leading to the summit of Mount Fuji. The third locality, Itchigome (alt. c. 2000 m) is similarly not the name of a village. All trails on Mount Fuji are divided into 10 sections delimited by "stations", named from 1 (= ichi) to 10 (ju) followed by "gome". "Ichi" is a better transcription than "itchi" used by Nylander (1890). Ichigome on the trail which E. Almquist followed is located at an altitude of c. 1000 m (and Nigome (ni = 2) at 1500 m). Although the exact position of Ouma-gayeshi is unclear on this trail, it is certainly above Ichigome. This would seem to indicate that the positions of Ichigome and Ouma-gayeshi were inadvertially reversed by E. Almquist, and that specimens said to be collected at Ichigome were actually collected at Ouma-gayeshi and vice versa.

Material and Methods

Approximately 1050 collections of mainly crustose lichens as well as 17 collections by E. Sado were studied. The short morphological descriptions provided here are based only on Japanese collections. They can therefore differ slightly in some characters from descriptions based on material from other geographical regions, e.g., in the presence or absence of ascomata, chemistry, frequency of ascospores and/or minor differences in ascospore or conidia size. The species descriptions mainly follows the terminology in the lichen flora of Great Britain and Ireland (Purvis et al. 1992). All species except *Maronea constans* and *Porina mammillosa* have earlier been studied in the field in Europe by GT. All species have also been compared with European and occasionally North American herbarium materials (exsiccata and other collections) in TNS. All light microscopy measurements used in statistical calculations were made with an oil immersion lens on material mounted in water, achieving a precision of 1 μm. The soredia, ascospore and conidia measurements have been given as (min.-)X± SD(-max.), where X±SD are rounded to the nearest whole number. The number of soredia, ascospore and conidia measured differ depending on their frequency and the available material, but if possible 120 have been measured. The minimum value (min.) and the maximum value (max.) are the extreme values recorded. The mean value (X), the standard deviation (SD) and the total sample size (n) are given in parentheses. For the measurements of all other morphological characters, the values represent the extreme range. The ioidine colouration (Lugol's solution, 0.25%) was studied both with and without pretreatment with K; the former colouration here denoted the K/I colouration, the latter the I colouration. Calcium oxalate was identified under the microscopy by adding 25% H_2SO_4 under the cover-slip, causing the crystals to dissolve and recrystallize by forming needle-shaped crystals of calcium sulphate. Thin layer chromatography (TLC) was carried out in accordance with the method described by White and James (1985). Only the B system (HEF) was used. In the list of specimens examined, the collections are arranged from north to south.

Anisomeridium nyssaegenum (Ellis & Everh.) R. C. Harris

Thallus inconspicuous, effuse, greyish green to green; photobiont *Trentepohlia*, cells 8–18 μm in diameter. Perithecia few, ± globose, up to 0.2 mm in diameter, black; hymenium I– (but the ascus epiplasm stained yellow brownish), K–, K/I– (but the ascus epiplasm stained yellow brownish); pseudoparaphyses persistent, 1 μm wide, branched; asci cylindric-clavate, apical dome with short and broad ocular chamber, 8-spored with the ascospores biseriate, 55–65×12–14 μm. Ascospores thin-walled, clavate-fusiform, colourless, 1-septate (the septae just below the middle), (13–)13–16(–18) × (5–)5–6(–6) μm (Length: X = 14.9 μm, SD = 1.5 μm, n = 60; Width: X = 5.2 μm, SD = 0.4 μm, n = 60). Pycnidia frequent, up to 0.1 mm in diameter, conical with macroconidia bound by a gelatinous matrix extruding as a white cirrus; macroconidia ellipsoid to ovoid, (4–)5(–6) × (2–)2(–2) μm (Length: X = 5.0 μm, SD = 0.4 μm, n = 120; Width: X = 2.0 μm, SD = 0.0 μm, n = 120).

Notes. *Anisomeridium nyssaegenum* is characterized by its peculiar conical pycnidia (Fig. 1c) with macroconidia bound by a gelatinous matrix extruding as a white cirrus, and by the small perithecia (Fig. 1a). The ascospores (Fig. 1b) are slightly longer and narrower than in *A. biforme* (9–16 × 4–7 μm) which is widely distributed in Europe, North America, West Indies, E. Asia and New Zealand (Purvis et al. 1992), but not reported from Japan.

Habitat. The species was collected at the base of an exposed, old *Prunus yedoensis* tree at the entrance of a shrine. The thalli were hidden by grass. It is accompanied by *Cladonia* sp. (only a few squamules), *Lepraria* sp., *Porina* sp. and an undetermined sorediate crustose lichen.

Distribution. *Anisomeridium nyssaegenum* is here reported from one locality in Japan where it was found with perithecia. Specimens with similar pycnidia but without perithecia were found at other localities but these observations are omitted here. *A. nyssaegenum* is widespread and common in large parts of northern and western Europe (e.g. Purvis et al. 1992, Santesson 1993) but is easily over-looked. It is also reported

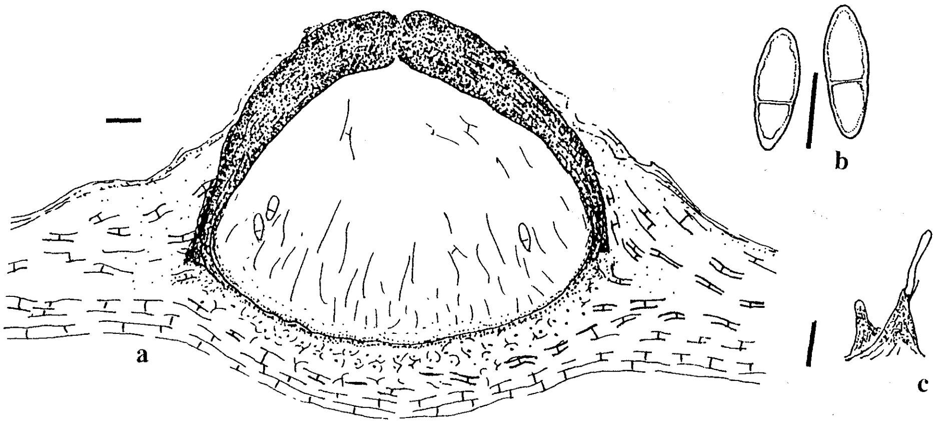

Fig. 1. *Anisomeridium nyssaegenum*. a. Cross section of a perithecium. b. Ascospores. c. Pycnidium with macroconidia. Scales: a = 20 μm, b = 10 μm, c = 50 μm.

from North America (Egan 1987) and Australia (Purvis et al. 1992).

Specimen examined. Honshu, Prov. Bizen (Pref. Okayama), Maniwa-gun, Kawakami-mura, shrine 2 km SW of Gohara, 35°15'N, 133°38'E, alt. 590 m, 7 August 1994, G. Thor 12222 (TNS).

Arthonia spadicea Leight.

Thallus immersed, effuse; photobiont *Trentepohlia*, cells 8–20 × 8–13 μm. Apothecia rounded to elongated, sometimes confluent, up to 1.0 mm in diameter, red-brown to blackish (paler at the edges); disc convex; hypothecium brownish; hymenium brownish, 30–45 μm tall, I+ red, K+ dull purplish, K/I+ red (but ascus apex with a blue ring); epithecium colourless to brownish; paraphysoids 1 μm wide, apices embedded in a clear gel-like layer; asci 8-spored, 28-40×13–15 μm. Ascospores only rarely seen outside the asci, ovoid to sole-shaped, colourless and smooth (also when old), 1-septate, slightly restricted at septae, (9–)10–11(–12) × (4–)4(–4) μm (Length: X = 10.4 μm, SD = 0.7 μm, n = 60; Width: X = 4.0 μm, SD = 0.0 μm, n = 60). Pycnidia not seen.

Notes. Within the genus *Arthonia Arthonia spadicea* (Fig. 2a) is most easily characterized by its large apothecia, as well as by its habitat ecology (see below). *Arthothelium* species often occur in the same habitat and can be similar, but are distinguished by the muriform ascospores. *Arthonia spadicea* has earlier been confused with *A. vinosa* which can be somewhat similar but *A. spadicea* occurs in a different habitat (see below), lacks orange-yellow staining of the thallus, and usually has larger apothecia (up to 1.5 mm in diameter) with distinctly smaller ascospores and an apothecial pigment which is paler in K (see also *A. vinosa*).

Habitat. The species was found on smooth bark at the shaded bases of trees in humid old forests. It was collected on *Abies veitchii* (11976), *Fagus crenata* (11853), *Quercus mongolica* v. *grosseserrata* (11891), and an undetermined deciduous tree (11954). It is accompanied by few other species, e.g., *Cladonia* sp. (only squamules), *Graphis* sp. and *Lepraria* sp. The altitudinal distribution ranges from c. 400 m to 920 m.

Distribution. *Arthonia spadicea* was collected at four localities in northern Honshu. It was searched for in more southern part of Honshu and in Kyushu but was not found. The species is widespread in Europe but is of rather sparse occurrence in some areas (Nimis 1993, Purvis et al. 1992, Santesson 1993). It is also reported from North America (Egan 1987) and South Africa (Purvis et al. 1992).

Specimens examined. Honshu, Prov. Mutsu (Pref. Aomori): SE slope of Mt. Ando, Saimura, Shimokita-gun, 41°14'N, 140°49'E, alt. 480 m, 18 May 1994, G. Thor 11853 (S, TNS); around Yachi Hot Spring, Mt. Hakkoda, 40°38'N, 140°56'E, alt. 750 m, 19 May 1994, G. Thor 11891 (S, TNS); c. 1 km E of Kasamatsu Pass along Road 103, Mt. Hakkoda, 40°37'N, 140°54'E, alt. 920 m, 20 May 1994, G. Thor 11976 (TNS); around Tsuta Hot Spring, Mt. Hakkoda, 40°36'N, 140°58'E, alt. 400–470 m, 19 May 1994, G. Thor 11954 (TNS).

Arthonia vinosa Leight.

Thallus immersed to inconspicuous, effuse, stained orange-yellow; photobiont Trentepohlia, cells 8-17 × 7-13 μm. Apothecia more or less rounded, convex, up to 0.4 mm in diameter, brownish black; hypothecium brown; hymenium brownish yellow, 50–60 μm tall, I+ pale blue, K+ purple-red, K/I+ blue; epithecium yellowish brown; paraphysoids 1 μm wide; asci 8-spored, 32–48 × 18–22 μm. Ascospores ovoid-ellipsoid, colourless and smooth but old ascospores brown and warted, 1-septate, (14–)15–17(–19) × (5–)6–7(–8) μm (Length: X = 15.9 μm, SD = 0.9 μm, n = 60; Width: X = 6.8 μm, SD = 0.6 μm, n = 60). Pycnidia not seen.

Notes. Within the genus *Arthonia Arthonia vinosa* most easily characterized by the orange-yellow stained thallus and the apothecial pigment which is K+ purple-red. *Arthonia vinosa* has earlier been confused with *A. spadicea* (see above). In Europe *Arthonia vinosa* is found both in broad-leaved deciduous forests (mainly on large *Quercus robur* and *Fraxinus*

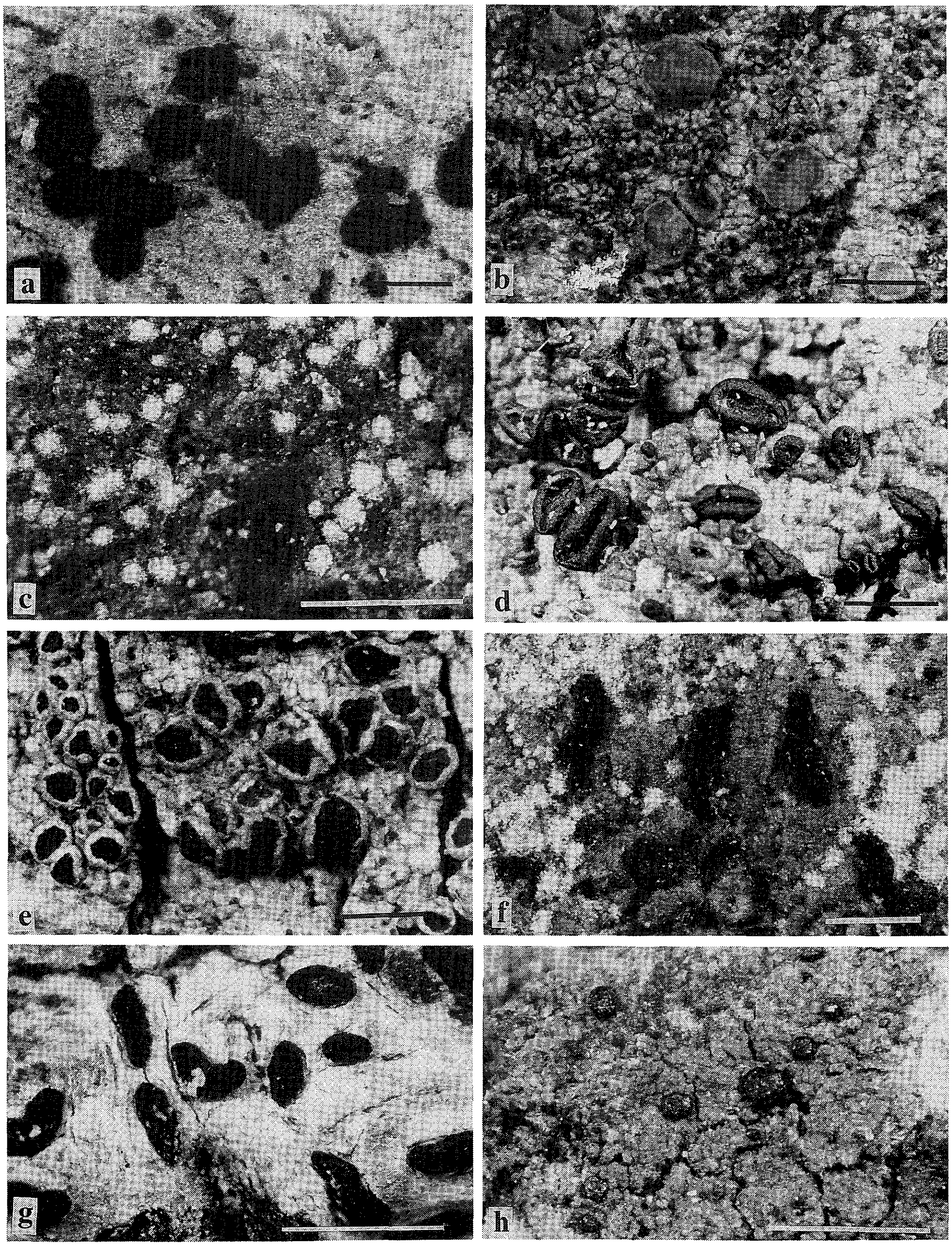

Fig. 2. a. *Arthonia spadicea*. b. *Cliostomum griffithii*. c. *Enterographa zonata* (with soralia). d. *Lopadium disciforme*. e. *Maronea constans*. f. *Opegrapha gyrocarpa*. g. *Opegrapha varia*. h. *Scoliciosporum chlorococcum*. Scales = 1 mm.

excelsior) in rather warm and dry habitats, and in old coniferous forests (mainly shaded on bases of *Picea abies*) with high air moisture in northern regions (Karström and Thor 1991). In both North America and Japan it occurs in humid old coniferous forests. The Japanese material only covers c. 4 mm^2 and includes about 12 apothecia.

Habitat. The species was collected on smooth bark of *Abies sachalinensis* rather close to the sea in the northwestern part of Hokkaido. It is accompanied by *Ramalina roesleri* (Hochst.) Hue and also several crustose species, e.g., *Cliostomum griffithii* and *Pachyphiale fagicola* (see these species) as well as *Biatora* sp., *Lecidea erythrophaea* Flörke (Sado s.n. TNS) and various undetermined species. *Lecidea meiocarpa* (now *Biatora meiocarpa*) was reported over bark from Itchigome on Mount Fuji by Nylander (1890). In Sato (1965), *Lecidea minuta* is reported and *L. meiocarpa* is given as a synonym. This information is most probably based on the information in Nylander (1890). However, the identity of *Lecidea minuta* is unclear but it might be a synonym of *Lecidea erythrophaea* (Santesson 1993). The material on which Nylander's report of *Lecidea meiocarpa* is based was not checked by us; it is housed at H. If that material proves to be conspecific with *Lecidea erythrophaea*, then this species is here confirmed as occurring in Japan. If not, it would be new to Japan.

Distribution. *Arthonia vinosa* was found at one locality in the northwestern part of Hokkaido. It was searched for by us in Honshu and Kyushu but was not found. The species is widespread in most of Europe but mainly in the western and middle parts (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993). It was also recently reported from North America (Goward and Thor 1992).

Specimen examined. Hokkaido, Prov. Teshio, Wakasakanai, 45°05'N, 141°37'E, alt. 30 m, October 1994, E. Sado s.n. (TNS).

Chrysothrix candelaris (L.) J. R. Laundon

Thallus leprose, diffuse, up to 0.2 mm thick, bright yellow to greenish yellow (in deep shade); granules ± globose, 16–40 μm in diameter; prothallus not seen; photobiont chlorococcoid, cells 6–14 μm in diameter. Apothecia not seen. Pycnidia not seen. Chemistry: calycin or pinastric acid and calycin; thallus C–, K–, PD–, UV–, medulla I–, K/I–.

Notes. *Chrysothrix candelaris* is easily recognized in the field by the thin, bright yellow, leprose thallus. It is apparently rather tolerant to air pollution, with one of the collections (Thor 12080) deriving from 70 km southwest of downtown Tokyo. In Japan this species seems to be a good indicator of *Cryptomeria japonica* forests or at least of groups of trees with long ecological continuity; it was only found in the neighbourhood of temples (12080, 12168) and shrines (12423). The genus *Chrysothrix* was revised by Laundon (1981) who reported no species from Japan. *Chrysothrix candelaris* might be somewhat similar to *Candelariella vitellina* (Hoffm.) Müll. Arg. which is also yellow. That species, however, has larger thallus granules (not leprose), is often fertile, is only rarely corticolous, and has a different chemistry (calycin, pulvinic dilactone, pulvinic acid). *Chrysothrix candelaris* has three chemotypes, one with calycin, one with pinastric acid and one with calycin and pinastric acid (Laundon 1981). Laundon (1981) reported that the chemotype with calycin is most frequent in temperate areas, whereas that with pinastric acid predominates in tropical areas. Specimens with calycin and pinastric acid are very rare, only three collections having been examined by Laundon (1981): two from the USA (Washington state, North Carolina) and one from St. Helena. A further specimen was also earlier reported from Germany, but is now lost (Laundon 1981). This chemotype has also recently been reported from Australia and South America on the basis of a single specimen each (Thor 1988). In the list of specimens examined, the chemistry is indicated within parentheses with the following symbols: calycin (I) and calycin and pinastric acid (II). The presence of calycin was easily detected by the orange colour of the acetone extract (see Laundon 1981).

Habitat. At two localities, the species was collected on dry bark of shaded sides of old *Cryptomeria japonica* trees, at one locality (11423) it was found on the deciduous tree *Actinodaphne lancifolia*

(Lauraceae), and at one locality (38076) on *Pinus densiflora*. On Mount Koya it was also observed (but not collected) on a shaded wall, as well as on a few, old sotoba (graw-markers: long, ± narrow wooden tablets). A few hundred metres from Ichinohashi bridge, a sotoba more than 4 m tall was almost completely covered with *Chrysothrix candelaris*, and was readily distinguished at about hundred metres distant. It co-occurs with e.g. *Caloplaca* sp., *Cladonia* sp., *Lecanora* sp., *Lepraria* spp., and undetermined crustose species. The altitudinal distribution ranges from 60 m to 800 m.

Distribution. *Chrysothrix candelaris* was found at four scattered localities, three in Honshu and one on the island Yakushima south of Kyushu. It was searched for at many other localities but not found. *Chrysothrix candelaris* is almost cosmopolitan and is absent from only one continent, Antarctica; elsewhere it is found from boreal to tropical regions (Laundon 1981).

Specimens examined. Honshu, Prov. Hitachi (Pref. Ibaraki), Tsukuba-san shrine, Mt. Tsukuba, Tsukuba-city, 36°17'N, 140°06'E, alt. 250 m, 11 February 1995, H. Kashiwadani 38076 (TNS) (II). Honshu, Prov. Sagami (Pref. Kanagawa), Iryuda, Odawara-city, Shodaiji temple, 35°14'N, 139°07'E, alt. 200 m, 26 June 1994, G. Thor 12080 & H. Kashiwadani (TNS) (II). Honshu, Prov. Kii (Pref. Wakayama), Mt. Koya, the walk from Ichinohashi bridge to the temple Okuno-in, 34°13'N, 135°35'E, alt. 800 m, 4 August 1994, G. Thor 12168 & H. Kashiwadani (TNS) (II). Kyushu, Prov. Ohsumi (Pref. Kagoshima), 3 km N of Anbo, Funayuki shrine, Yaku-cho, Yakushima Island, 30°20.5'N, 130°39.5'E, alt. 60 m, 27 October 1994, G. Thor 12423 (TNS) (I).

***Cliostomum griffithii* (Sm.) Coppins**

Thallus matt, granular to areolated, up to 0.2 mm thick, pale grey; photobiont chlorococcoid, cells 6–13 μm in diameter. Apothecia up to 0.8 mm in diameter; margin whitish grey; true exiple straw-coloured through minute granules; disc concave to flat, grey to blackish, thinly white-pruinose; hypothecium colourless; hymenium 35–50 μm tall, I+ blue, K–, K/I+ blue; epithecium granular, brownish yellow; asci 8-spored, 34–45 × 10–13 μm. Ascospores narrowly ellipsoid-oblong, colourless, 1-septate or rarely non-septate, (9–)11–13(–15) × (3–)3(–3) μm (Length: X = 11.9 μm, SD = 1.3 μm, n = 120; Width: X = 3.0 μm, SD = 0.0 μm, n = 120). Pycnidia frequent, up to 0.2 mm in diameter, black; pycnidium wall K ± purple; conidia ovoid to ovoid-cylindrical, (4-)4(–5) × (2–)2(–2) μm (Length: X = 4.1 μm, SD = 0.3 μm, n = 120; Width: X = 2.0 μm, SD = 0.0 μm, n = 120). Chemistry: Atranorin, roccellic acid (TLC); thallus C–, K+ yellow, PD ± yellow, UV ± grey-white.

Notes. *Cliostomum griffithii* (Figs. 2b, 4) is characterized by the grey to blackish, thinly white-pruinose apothecia and by the frequent, characteristic black and rather large pycnidia which walls are K ± purple.

Habitat. The species was collected on bark of *Abies sachalinensis* rather close to the sea. It is accompanied by *Ramalina roesleri* and also several crustose species, e.g., *Arthonia vinosa* and *Pachyphiale fagicola* (see these species) as well as by *Biatora* sp., *Lecidea erythrophaea* (see *Arthonia vinosa*) and undetermined species.

Distribution. *Cliostomum griffithii* was found at one locality in the northwestern part of Hokkaido. It was searched for but not found by us in Honshu and Kyushu. The species is widespread in Europe and is common in many areas but has a mainly western distribution (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993). It is also reported from North America (Egan 1987), Tasmania (Kantvilas 1994), and New Zealand (Galloway 1985).

Specimen examined. Hokkaido, Prov. Teshio, Wakasakanai, 45°05'N, 141°37'E, alt. 30 m, October 1994, E. Sado s.n. (TNS).

***Enterographa zonata* (Körb.) Källsten**

Thallus up to 0.2 mm thick, effuse, greenish brown to brown, forming rosettes up to 4 cm in diameter; prothallus not seen but a brown to black border is present when in contact with other lichen thalli; medulla with calcium oxalate crystals; photobiont *Trentepohlia*, cells 12–21 × 7–15 μm; soralia frequent, rounded, scattered, rarely confluent, up to 0.2

mm in diameter, dark brown with a lilac tinge when young (due to pigmentation of the external soredia) and then convex, but later, when most of the soredia have been shed, pale yellowish white and plane; soredia wall usually distinct but sometimes indistinct, farinose, (12–)15–19(–23) μm in diameter (Length: X = 16.7 μm, SD = 2.2 μm, n=120). Apothecia not seen. Pycnidia not seen. Chemistry: confluentic and 2'-O-methylmicrophyllinic acids; thallus C–, K–, KC–, PD–, UV–.

Notes. *Enterographa zonata* (Fig. 2c) is characterized by the presence of pale, rather small soralia, a distinctive chemistry, the *Trentepohlia* algae and the habitat (see below). It is similar to *Opegrapha gyrocarpa* (see this species) but differs in the usually smaller soralia which only rarely become confluent, the lilac tinge of the soralia, and the different chemistry. The apothecia are also different but are not known to occur in Japanese specimens of *Enterographa zonata*. The Japanese material of the two species also differ in that *Enterographa zonata* contains calcium oxalate crystals in the medulla while *Opegrapha gyrocarpa* lacks calcium oxalate. However, it is unclear whether this difference obtains in material from outside Japan; no information about calcium oxalate in these two species is included in Purvis et al. (1992), Tønsberg (1992) or Tønsberg and Brodo (1992). The collected specimen do not form mosaic-like colonies which is common in Europe (Purvis et al. 1992, Tønsberg 1992).

Habitat. The species was found on dry to rather dry, overhanging, shaded siliceous rock in a forest with a high air moisture in an montane area. It is accompanied only by *Lepraria* sp. and a undetermined thalli of a crustose species.

Distribution. *Enterographa zonata* was collected at one locality in central Honshu and was not found in Kyushu. The species is widespread in Europe but most frequent in the western, northwestern and central parts (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993, Wirth 1987), and has recently been reported from northern Africa (Torrente and Egea 1989), as well as from North America (Tønsberg and Brodo 1992). It is classified as an suboceanic species by Tønsberg and Brodo (1992).

Specimens examined. Honshu, Prov. Etchu (Pref. Toyama), 30 km ESE of Toyama, Syomyo-zaka, 600 m W of Syomyo waterfall, just S of the river, path in the steep N slope, Tateyama-cho, Nakaniikawa-gun, 36°34'N, 137°31'E, alt. 1160–1220 m, 15 November 1994, G. Thor 12624 (S, TNS).

Lopadium disciforme (Flot.) Kullh.

Thallus of closely attached, minute dispersed granules to almost a continuous and smooth thallus, up to 0.1 mm thick, brownish green; photobiont chlorococcoid, cells 6–13 μm in diameter. Apothecia up to 0.7 mm in diameter, dull black; disc concave to flat; hypothecium greyish brown; hymenium 75–95 μm tall, I+ constantly blue (mainly ascus walls), K–, K/I+ constantly blue (mainly ascus walls); paraphyses 2–3 μm wide, simple; paraphyse apices brown-capped, 4–7 μm wide; asci 1-spored, 69–85 × 25–28 μm. Ascospores ellipsoid, colourless, muriform, (48–)53–66(–73) × (19–)22–27(–30) μm (Length: X = 59.4 μm, SD = 6.1 μm, n = 50; Width: X = 24.6 μm, SD = 2.6 μm, n = 50). Pycnidia not seen.

Notes. *Lopadium disciforme* (Fig. 2d) is characterized by the closely attached thallus, the small, entirely black apothecia and the distinctive habitat. *L. pezizoideum* is somewhat similar but is found on mosses and plant remains on the ground in alpine habitats. The two species differ also in the iodine reaction of the hymenium; *L. disciforme* is I+ constantly blue while *L. pezizoideum* is I+ blue changing to brownish.

Habitat. The species was collected on *Thujopsis dolobrata* at c. 1.5 m above the ground in an open, mixed coniferous/deciduous forest. It is accompanied by e.g. *Lecidella* sp., *Megalospora* sp., *Pertusaria* sp. and *Rinodina* sp.

Distribution. *Lopadium disciforme* is widespread in boreal and montane areas in Europe (e.g., Nimis 1993, Purvis et al. 1992, Santesson 1993), and is also reported from North America (Egan 1987) and Tasmania (Kantvilas 1994). Within Lopadium s. str., only *L. pezizoideum* is reported from Japan (Honshu and Hokkaido) (Kurokawa and Kashiwadani 1977). Four of the five reported collections have been reexamined, and are all *L. disciforme*. One collection from Mt. Fuji in H has not been examined but is reportedly collected on *Picea* sp. (Kurokawa and Kashiwadani 1977), and is therefore probably also *Lopadium disciforme*. Two more recently collected specimens in TNS are listed below. *Lopadium pezizoideum* should be omitted from the Japanese lichen flora.

Specimen examined. Hokkaido, Prov. Kushiro, c. 2 km N of Miyajima-misaki, Tsurui-mura, Akan-gun, 43°08'N, 144°24'E, alt. 10 m, 9 December 1994, H. Kashiwadani 38025 (TNS). Honshu, Prov. Mutsu (Pref. Aomori), SE slope of Mt. Ando, Sai-mura, Shimokita-gun, 41°14'N, 140°49'E, alt. 480 m, 18 May 1994, G. Thor 11860 (TNS). Prov. Shimotsuke, lakeside of Yumoto, Nikko, alt. c. 1460 m, 19 September 1981, S. Kurokawa 81003 (TNS).

Maronea constans (Nyl.) Hepp

Thallus of closely attached granules, usually grown together, ± circular, up to 1 cm in diameter, up to 0.2 mm thick, greenish; prothallus sometimes staining the bark brownish black; photobiont chlorococcoid, cells 6–15 μm in diameter. Apothecia rounded, with a clearly constricted base, up to 0.8 mm in diameter; margin greenish; thalline exiple with small calcium oxalate crystals (5–10 μm in diameter); disc dark red-brown, flat or sometimes convex or concave; hypothecium hyaline; hymenium with numerous oil-drops, 70–85 μm tall, I+ blue (mainly (only?) ascus walls), K–, K/I+ blue (mainly (only?) ascus walls); epithecium brown; paraphyses branched, surrounded by a granular gelatinous matrix, 2 μm wide; paraphyse apices 3–5 μm wide; asci >100-spored, 70–80 × 18–22 μm. Ascospores ellipsoid but often slightly constricted in the middle, colourless, simple but often with a ± unclear pseudoseptae, (4–)4–5(–5) × (2–)2–3(–3) μm (Length: X = 4.7 μm, SD = 0.5 μm, n = 60; Width: X = 2.6 μm, SD = 0.5 μm, n = 60). Pycnidia not seen. Chemistry: 2 unknown substances, rf 6 (major) and rf 5–6 (minor) (both orange yellow after charring with H_2SO_4 and heating, with age changing to more brownish); thallus C–, K–, PD–, UV–.

Notes. *Maronea constans* (Fig. 2e) can be somewhat similar to a *Lecanora* species in the field but is easily characterized by its >100-spored asci. Within the genus *Maronea*, the species is characterized by the occurrence in the ascospores of ± unclear pseudoseptae, by the rather thin hymenium, and by the pale I reaction of the hymenium. In his revision of *Maronea*, Magnusson (1934) observed that *Maronea constans* might possibly be found in Asia, and that that species would thus have a northern circumpolar distribution. The genus *Maronea* comprises c. 13 species, most of which have a tropical distribution, and none of which has previously been reported from Japan. The two unknown substances detected by TLC were found also in *Maronea constans* from Europe (Vězda Lich. Sel. Exs. 840).

Habitat. The species was collected on the rather smooth bark of an exposed deciduous tree at a roadside in a slightly dust-impregnated and nitrophytic habitat. The tree supported a very rich epiphytic flora, including e.g. *Ochrolechia* sp., *Parmelia praesquarrosa* Kurok., *Pertusaria* sp., *Phaeophyscia* sp., *Rinodina* sp., and various sorediate, undetermined crustose species.

Distribution. *Maronea constans* was collected at one locality in the western, middle portion of Honshu. The species is widespread in Europe but absent in western and northern regions. It is, however, disappearing in many parts of Europe (e.g. Nimis 1993, Poelt 1969, Santesson 1993), possibly due to air pollution. It is reported also from North America (Egan 1987), Tasmania (Kantvilas 1994) and New Zealand (Galloway 1985).

Specimen examined. Honshu, Prov. Bizen (Pref. Okayama), Maniwa-gun, Kawakami-mura, 1–2.3 km N of Hiruzen Research Institute, 35°18'N, 133°38'E, alt. 500–550 m, 6 August 1994, G. Thor 12215 (S, TNS).

Opegrapha gyrocarpa Flot.

Thallus up to 0.3 mm thick, effuse, brownish green to greenish brown to brown; prothallus not present or dark brown to black; medulla lacking calcium oxalate; photobiont *Trentepohlia*, cells 12–23 × 12–19 μm; soralia frequent, rounded to irregularly elongate, scattered, ± confluent, up to 0.8 mm in diameter, greenish brown when young (only rarely seen) due to pigmentation of the external soredia and then convex, but later, when most of the soredia have been shed, pale yellowish white and plane; soredia wall usually distinct but sometimes indistinct, farinose, (15–)18–24(–34) μm in diameter (Length: X = 21.1 μm, SD = 3.1 μm, n = 120). Apothecia frequent (11815) or not present (12247), elongate to gyrose and rounded, sessile, not pruinose, up to 1.3 mm long and 0.8 mm wide, black; hypothecium brown; hymenium 70–85 μm tall, I+ pale blue rapidly changing to reddish brown except the c. 5-10 μm tall subhymenium which is persistently pale blue, K–, K/I+ persistently pale blue; epithecium granular, brown; paraphysoids branched, 1–2 μm wide; paraphysoid apices 1–3 μm wide; asci 8-spored, 53–70 × 14–20 μm. Ascospores slightly clavate, straight, colourless, 3-septate, (14–)16–19(–20) × (5–)5–6(–7) μm (Length: X = 17.4 μm, SD = 1.6 μm, n = 60; Width: X = 5.8 μm, SD = 0.5 μm, n = 50). Pycnidia scattered, black, up to c. 0.05 mm in diameter (only seen on 11815); conidia bacilliform, (5–)5–6(–6) × (1-)1(–1) μm (Length: X = 5.2 μm, SD = 0.4 μm, n = 120; Width: X = 1.0 μm, SD = 0.0 μm, n = 120). Chemistry: Schizopeltic acid and accessory (part of 11815) or psoromic acid (12247 and part of 11815); thallus C–, K–, KC–, PD– or PD+ yellow, UV– or UV+ whitish.

Notes. *Opegrapha gyrocarpa* (Fig. 2f) is characterized by the pale, rather large soralia, the distinctive chemistry, the presence of *Trentepohlia*, the habitat (see below) and, if present, also the apothecia. It is similar to *Enterographa zonata* (see this species) but has typically larger, often confluent soralia which lack a lilac tinge, and contains schizopeltic or psoromic acid. The apothecia are also distinctive. Japanese *Enterographa zonata* also contain calcium oxalate crystals in the medulla, whereas *Opegrapha gyrocarpa* lacks calcium oxalate. It is unclear whether this difference holds fore material from outside Japan. Three chemotypes have been reported for this species: one with gyrophoric acid, one with schizopeltic acid, and one with gyrophoric acid and schizopeltic acid (Tønsberg 1992). Two chemotypes were found in Japan, one with schizopeltic acid (and accessory) and a new with psoromic acid. At one locality (11815), the two chemotypes were growing intermixed. They are easily separated by the UV reaction, schizopeltic acid being UV+ whitish, and psoromic acid being UV–. Apothecia were found on both chemotypes in this collection but were more frequent on the psoromic acid chemotype (the morphological description has been made on thalli with psoromic acid).

Habitat. The species was found on dry to rather dry, vertical or overhanging, shaded, siliceous rocks in highly humid habitats in montane areas. It is accompanied by few other species, *Lepraria* sp., *Porina chlorotica* (Ach.) Müll. Arg. (G. Thor 11816, TNS, S), and *Porpidia* sp. *Porina chlorotica* has earlier been reported from Japan (Mourayama) only by Nylander (1890). The substrate is reported to be lava (Nylander 1890). The material based on the report by Nylander is housed in H, and was not checked by us. The altitudinal distribution ranges from 620 m to 700 m.

Distribution. *Opegrapha gyrocarpa* was collected at two widespread localities in Honshu but was not found in Kyushu. The species is widespread in northern, middle and western Europe, and the Azores (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993, Wirth

1987). It is recently also reported from North America (Tønsberg and Brodo 1992).

Specimens examined. Honshu, Prov. Mutsu (Pref. Aomori), Mt. Nuidoiwa, Sai-mura, Shimokita-gun, 41°19'N, 140°51'E, alt. 620 m, 17 May 1994, G. Thor 11815 (S, TNS). Honshu, Prov. Bizen (Pref. Okayama), Maniwa-gun, Kawakami-mura, walk from shrine to view-point, 2 km SW of Gohara, 35°15'N, 133°37'E, alt. 700 m, 7 August 1994, G. Thor 12247 (TNS).

Opegrapha varia Pers.

Thallus effuse, immersed and staining the bark grey to greyish green; photobiont *Trentepohlia*, cells 7–17 μm in diameter. Apothecia elongate, sometimes branched, sessile, up to 1.3 × 0.3 mm, black; disc not pruinose, hypothecium black; hymenium 65–75 μm tall, I+ red, K/I+ red; epithecium brown, K–; paraphysoids branched, 1–2 μm wide; paraphysoid apices granular, brown, 2–3 μm wide; asci 8-spored, 58–66 × 15–17 μm. Ascospores somewhat clavate, the middle cells somewhat enlarged, with an up to 1 μm thick perispore and rounded ends, becoming brownish when old, 5-septate or rarely 4- or 6-septate, (17–)19–22(–23) × (5–)6(–7) μm (Length: X = 20.1 μm, SD = 1.4 μm, n = 120; Width: X = 6.0 μm, SD = 0.4 μm, n = 120). Pycnidia not pruinose, black, up to c. 0.05 mm in diameter; pycnidium wall K–; conidia bacilliform, (3–)4–5(–5) × (2–)2(–2) μm (Length: X = 4.1 μm, SD = 0.4 μm, n = 120; Width: X = 2.0 μm, SD = 0.0 μm, n = 120). Chemistry: Thallus C–, K–, PD–, UV–.

Notes. *Opegrapha varia* (Fig. 2g) is a variable species but is characterized by the 4–6-septate ascospores which are wider than in other *Opegrapha* species with ascospores with the same number of septae. The disc and pycnidia are sometimes ± white- to grey- to green-pruinose, at least in Europe. However, the Japanese collection lacks pruina.

Habitat. The species was found on rough bark at the base of a large *Fagus crenata* in an old, open *Fagus crenata* forest with high humidity. It is accompanied by an undetermined sorediate crustose lichen with chlorococcoid algae, and an undetermined crustose lichen with whitish thallus, *Trentepohlia* algae and pycnidia with brown macroconidia c. 13–15-septate, 43–55 × 3–4 μm (cf. *Eopyrenula* sp.).

Distribution. *Opegrapha varia* was collected at one locality in northern Honshu. The species is widespread and common in most of Europe, but absent in northernmost region (e.g., Purvis et al. 1992, Nimis 1993, Santesson 1993). It has also been reported from North Africa (e.g., Nimis 1993), southern Siberia (e.g., Nimis 1993), and North America (Egan 1987).

Specimen examined. Honshu, Prov. Mutsu (Pref. Aomori), Mt. Nuidoiwa, Sai-mura, Shimokita-gun, 41°19'N, 140°51'E, alt. 380–626 m, 17 May 1994, G. Thor 11760 (S, TNS).

Pachyphiale carneola (Ach.) Arnold

Thallus inconspicuous, greyish green; photobiont *Trentepohlia*, cells 9–19 μm in diameter. Apothecia scattered, up to 0.3 mm in diameter, red-brown; disc concave; hypothecium colourless; hymenium 100–120 μm tall, I+ pale blue (mainly ascus walls), K–, K/I+ pale blue (mainly ascus walls); epithecium granular, red-brown; paraphyses unbranched or sparsely branched in the upper part, 1–2 μm wide; paraphyse apices 2–3 μm wide; asci c. 16-spored, 80–110 × 18–22 μm. Ascospores acicular, somewhat curved or flexuous, colourless, laying parallel to one another in ascus, 7–12-septate, (43–)47–54(–56) × (3–)3–4(–4) μm (Length: X = 50.5 μm, SD = 3.7 μm, n = 50; Width: X = 3.2 μm, SD = 0.4 μm, n = 50). Pycnidia not seen.

Notes. *Pachyphiale carneola* (Fig. 3a) is distinguished from *P. fagicola* (see below) by the former's longer and more septate ascospores (Fig. 3b), as well as by its occurrence in suboceanic to oceanic areas (see below). The genus *Pachyphiale* comprises c. five species and has not previously been reported from Japan. Two species, *Pachyphiale carneola* and *P. fagicola*, are here reported as new to Japan. A key to the four European species is found in Poelt (1969).

Habitat. The species was collected near a small

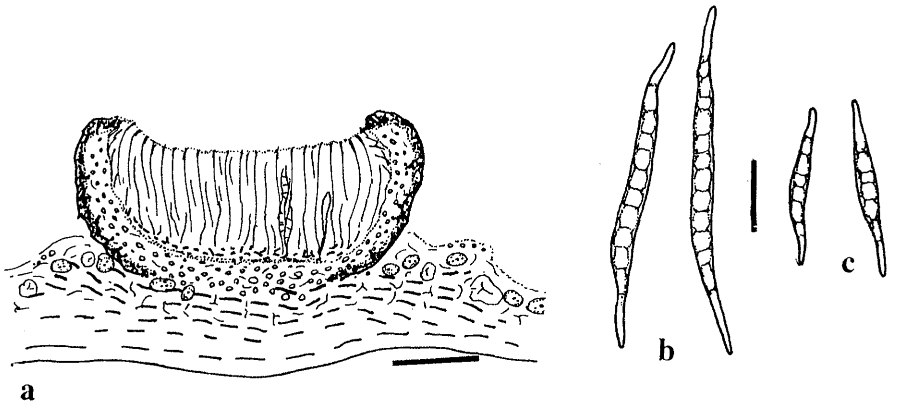

Fig. 3. Cross section of an apothecium of *Pachyphiale carneola*. b. Ascospores of *Pachyphiale carneola*. c. Ascospores of *Pachyphiale fagicola*. Scales: a = 100 µmm, b, c = 10 µm.

stream at the base of an old, shaded, deciduous tree in a small remnant, deciduous forest with high humidity. It was accompanied by e.g. *Arthonia* sp., *Dimerella* sp., *Lecanora* sp. and *Megalospora* sp. In Europe *Pachyphiale carneola* is found in suboceanic to oceanic areas in sheltered, broad-leaved deciduous forests which usually have a long environmental continuity whereas, *P. fagicola* is mainly boreal and is found in a large variety of different but open deciduous forests.

Distribution. *Pachyphiale carneola* was collected at one locality in the western, middle portion of Honshu. The species is widespread but is most frequent in western, middle and southern regions of Europe (e.g., Nimis 1993, Purvis et al. 1992, Santesson 1993). It is now decreasing, at least in some areas, due to air pollution and forestry. It is also reported from South Africa and North America (Poelt 1969; not reported from North America by Egan 1987, 1989 or 1990), South America (Purvis et al. 1992), and New Zealand (Galloway 1985).

Specimen examined. Honshu, Prov. Bizen (Pref. Okayama), Maniwa-gun, Kawakami-mura, 1–2.3 km N of Hiruzen Research Institute, 35°18'N, 133°38'E, alt. 500–550 m, 6 August 1994, G. Thor 12189 (TNS).

Pachyphiale fagicola (Hepp) Zwackh

Thallus immersed to smooth and up to 0.1 mm thick, green with a slight brownish tinge; photobiont *Trentepohlia*, cells 7–16 µm in diameter. Apothecia scattered, up to 0.3 mm in diameter, red-brown; disc concave; hypothecium colourless; hymenium 100–120 µm tall, I+ pale blue (mainly ascus walls), K–, K/I+ (mainly ascus walls); epithecium granular, red-brown; paraphyses unbranched or sparsely branched in the upper part, 1–2 µm wide; paraphyse apices 2–3 µm wide; asci c. (16–)32-spored, 80–95 × 18–30 µm. Ascospores acicular, somewhat curved or flexuous, colourless, laying parallel to one another in ascus, 5–8-septate, (18–)23–29(-33) × (3–)3(–4) µm (Length: X = 25.7 µm, SD = 3.0 µm, n = 120; Width: X = 3.1 µm, n = 120). Pycnidia not seen.

Notes. *Pachyphiale fagicola* is distinguished from *P. carneola* (see above) by its shorter and less septate ascospores (Fig. 3c) and also by its occurrence in mainly boreal areas (see *P. carneola*).

Habitat. The species was collected on bark of *Abies sachalinensis* rather close to the sea in the northwestern part of Hokkaido. It was accompanied by *Ramalina roesleri* and also by several crustose species, e.g., *Arthonia vinosa* and *Cliostomum griffi-*

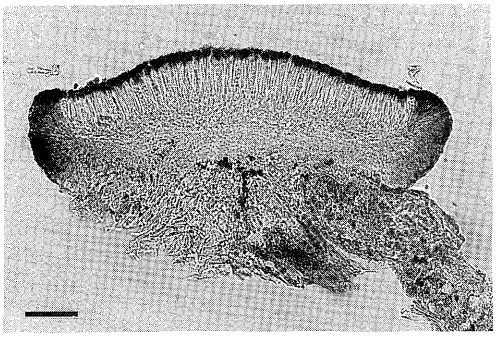

Fig. 4. Cross section of an apothecium of *Cliostomum griffithii*. Scale = 100 μm.

thii (see those species) as well as *Biatora* sp., *Lecidea erythrophaea* (see *Arthonia vinosa*) and undetermined species (see also *Pachyphiale carneola*).

Distribution. *Pachyphiale fagicola* was found at one locality in the northwestern part of Hokkaido. It was searched for but not found by us in Honshu and Kyushu. In Europe the species is widespread but often rare (or, at least in some areas, possibly overlooked) (e.g., Purvis et al. 1992, Nimis 1993, Santesson 1993). It has also been reported from southern Siberia (Nimis 1993), and North America (Egan 1987).

Specimen examined. Hokkaido, Prov. Teshio, Wakasakanai, 45°05'N, 141°37'E, alt. 30 m, October 1994, E. Sado s.n. (TNS).

Porina mammillosa (Th. Fr.) Vain.

Thallus effuse, smooth, up to 0.1 mm thick, brownish green-grey; photobiont *Trentepohlia*, cells 14–30 μm in diameter. Perithecia prominent, globose, up to 0.4 mm in diameter, brownish black; involucrellum thick, outer layers black, central layers purple-red, inner layers ± pale red; paraphyses rarely branched, 1–2 μm wide; asci 8-spored. Ascospores fusiform, colourless, 3-septate, (21–)21–26(–27) × (4–)5(–5) μm (Length: X = 23.4 μm, SD = 2.2 μm, n = 50; Width: X = 4.8 μm, SD = 0.4 μm, n = 50). Pycnidia not seen.

Notes. *Porina mammillosa* is characterized by the combination of 3-septate ascospores and the habitat. The Japanese specimen only covers c. 1 cm^2, but several perithecia are present.

Habitat. The species was collected at the mossy base of a large, shaded shrub in a small ravine near the peak of a mountain. It was found over mosses and plants remains, and was accompanied by only *Cladonia* sp.

Distribution. *Porina mammillosa* was found at only one locality in northern Honshu. It is reported from scattered localities in boreal and montane areas of Europe (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993), and is also reported from North America (Egan 1987).

Specimen examined. Honshu, Prov. Mutsu (Pref. Aomori), Mt. Nuidoiwa, Sai-mura, Shimokita-gun, 41°19'N, 140°51'E, alt. 620 m, 17 May 1994, G. Thor 11832 (TNS).

Scoliciosporum chlorococcum (Graewe ex Stenh.) Vězda

Thallus effuse, irregularly granular, granules scattered to contiguous, up to 0.3 mm thick, dark green to blackish green; photobiont chlorococcoid, cells 7–16 μm in diameter. Apothecia up to 0.3 mm in diameter, dark red-brown to dark brown-black; disc convex, usually shiny; hypothecium hyaline; hymenium 40–55 μm tall, I+ blue, K–, K/I+ blue; epithecium blue-green to blue-greenish brown to rarely brownish; paraphyses branched, 1 μm wide; paraphyse apices 1–2 μm wide; asci 8-spored, 38–44 × 16–19 μm. Ascospores elongate-spindle-shaped, tapered at one end, straight to curved, colourless, laying parallel to one another in ascus, 7-septate or rarely 8-septate, (24–)26–30(–35) × (4–)4–5(–5) μm (Length: X = 28.7 μm, SD = 2.7 μm, n = 120; Width: X = 4.4 μm, SD = 0.5 μm, n = 120). Pycnidia not seen.

Notes. *Scoliciosporum chlorococcum* (Fig. 2h) is characterized by the often shiny apothecia, the wide ascospores (Fig. 5a) which are not spirally twisted in the ascus, and the habitat (see below and also *S.*

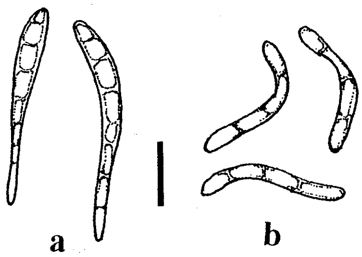

Fig. 5. a. Ascospores of *Scoliciosporum chlorococcum*. b. Ascospores of *Scoliciosporum umbrinum*. Scale = 10 μm.

umbrinum). The genus *Scoliciosporum* has not previously been reported from Japan. Two species, *Scoliciosporum chlorococcum* and *S. umbrinum*, are here reported as new to Japan.

Habitat. The species was collected on acid bark on thin branches or twigs, as well as on the bark of deciduous trees (11843, 12190 & 12542, undetermined species; 12293, *Alnus* sp.) and the coniferous trees *Pinus densiflora* (12302) and *Abies mariesii* (12681). It is usually accompanied by few other species, e.g. *Lecanora subfusca* s. lat. and *Lecanora symmicta* (Ach.) Ach (with no. 11843). *Lecanora symmicta* (as *L. symmictera*) has previously been reported from Japan only by Nylander (1890). The altitudinal distribution ranges from 500–550 m to 1960–2000 m.

Distribution. *Scoliciosporum chlorococcum* was collected at five localities in Honshu and Kyushu. The species was detected at most localities where suitable habitat was found except at the lowermost altitudes, and appears to be widely distributed and common in Japan. It is widely distributed and common in large parts of Europe (e.g. Nimis 1993, Purvis et al. 1992, Santesson 1993), and has also been reported from North America (Egan 1987).

Specimens examined. Honshu, Prov. Mutsu (Pref. Aomori), Mt. Nuidoiwa, Sai-mura, Shimokita-gun, 41°19'N, 140°51'E, alt. 620 m, 17 May 1994, G. Thor 11843 (S, TNS). Honshu, Prov. Etchu (Pref. Toyama), 33 km ESE of Toyama, Midagahara, along the path to Tateyama crater 500 m SSE of Midagahara bus stop, Tateyama-cho, Nakaniikawa-gun, 36°34'N, 137°34'E, alt. 1960–2000 m, 16 November 1994, G. Thor 12681 (S, TNS). Honshu, Prov. Bizen (Pref. Okayama), Maniwa-gun, Kawakami-mura, 1–2.3 km N of Hiruzen Research Institute, 35°18'N, 133°38'E, alt. 500–550 m, 6 August 1994, G. Thor 12190 (TNS). Kyushu, Prov. Ohsumi (Pref. Kagoshima), the path from the lake Fudo-ike to the lake Mi-ike, Kirishima Mts., 31°57'N, 130°52'E, alt. 1260–1280 m, 24 October 1994, G. Thor 12293 & 12302 (S, TNS). Kyushu, Prov. Ohsumi (Pref. Kagoshima), 11 km W of Anbo, 4 km W of Yakusugi-land, road-side, Yakushima Island, 30°18'N, 130°32.5'E, alt. 1275 m, 31 October 1994, G. Thor 12542 (S, TNS).

Scoliciosporum umbrinum (Ach.) Arnold

Thallus effuse, scurfy, up to 0.2 mm thick, green; photobiont chlorococcoid, cells 8–15 μm in diameter. Apothecia up to 0.4 mm in diameter, red-brown to dark brown-black; disc convex to plane; hypothecium hyaline; hymenium 50–60 μm tall, I+ blue, K–, K/I+ blue; epithecium bluish brown to brownish; paraphyses branched, 1 μm wide; paraphyse apices 1–2 μm wide; asci 8-spored, 42–50 × 14–16 μm. Ascospores only rarely seen outside the asci, needle-shaped, spirally twisted, colourless, spirally arranged in ascus, 3–4-septate, 18–24 × 2–3 μm. Pycnidia not seen.

Notes. *Scoliciosporum umbrinum* is characterized by the narrow ascospores (Fig. 5b) which are spirally twisted in the ascus (see also *S. chlorococcum*).

Habitat. The species was collected on a slightly shaded rock near the seashore. It was accompanied by e.g., the widely distributed *Caloplaca citrina* (Hoffm.) Th. Fr., *C. holocarpa* (Hoffm.) A. E. Wade, and an undetermined sorediate, crustose species.

Distribution. *Scoliciosporum umbrinum* was collected at one locality in northern Honshu. However, similar specimens were observed elsewhere but were not collected owing to their occurrence on smooth, hard siliceous rocks. The species might therefore be more widespread in Japan than here reported. It is, at any rate, widely distributed in Europe (e.g., Nimis 1993, Purvis et al. 1992, Santesson 1993), and has also been reported from North America (Egan 1987) and Australia (Hafellner et al. 1989).

Specimen examined. Honshu, Prov. Mutsu (Pref. Aomori), Wakinosawa, Shimokita-gun, alt. 5 m, 18 May 1994, G. Thor 11868 (TNS).

Strangospora moriformis (Ach.) Stein.

Thallus greyish green, irregularly granular, thin, effuse; photobiont chlorococcoid, cells 8–15 μm in diameter. Apothecia up to 0.4 mm in diameter, brownish black; true exiple thin to almost absent; hypothecium colourless; hymenium 70–80 μm tall, I+ blue, K–, K/I+ blue; epithecium bluish brown to bluish, K+ pale greenish grey, N+ mauve-purple; paraphyses branched, 1 μm wide; paraphyse apices colourless, 1–2 μm wide; asci >100-spored, 55–65×17–22 μm. Ascospores globose, colourless, simple, (3–)3–4(–5) μm (Length: X = 3.7 μm, SD = 0.5 μm, n = 120). Pycnidia not seen.

Notes. *Strangospora moriformis* is characterized by the dark (blackish) apothecia and the epithecium which usually has a bluish to violet tinge. The genus has not previously been reported from Japan. *Strangospora* is similar to *Biatorella* but might be distinguished by the asci which lack a gelatinous outer layer and have a strongly I+ blue apical dome.

Habitat. The species was collected at trail edge on the exposed bark of a dead and partly decorticated *Abies mariesii* snag at the edge of a vulcanic crater The specimen covered an area of only c. 1 cm^2. The bark of this tree supported a very rich crustose lichen flora, e.g., *Caloplaca* spp., *Japewia tornoënsis* (Nyl.) Tønsberg (G. Thor 12707, TNS), *Lecidea* sp., *Lepraria* sp., *Lopadium* sp., *Megalospora* sp., *Normandina pulchella* (Borrer) Nyl. and *Rinodina* sp. *Japewia tornoënsis* (as *Lecidea tornoënsis*) has previously been reported from Japan (over *Pinus* at Itchigome on Mount Fuji) only by Nylander (1890). The material on which Nylander's report is based is housed in H, and has not been checked by us.

Distribution. *Strangospora moriformis* was collected at one locality in central Honshu. The species is widespread in northern and middle Europe, mainly in montane areas (e.g., Nimis 1993, Purvis et al. 1992, Santesson 1993). It has also been reported from North America (Egan 1987).

Specimen examined. Honshu, Prov. Etchu (Pref. Toyama), 33 km ESE of Toyama, Midagahara, along the path to Tateyama crater 500 m SSE of Midagahara bus stop, Tateyama-cho, Nakaniikawa-gun, 36°34'N, 137°34'E, alt. 1960–2000 m, 16 November 1994, G. Thor 12698 (TNS).

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Endnote

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柏谷博之，ヨーラン・トール：**日本新産の周北極要素の固着地衣類**

1994年に著者らが実施した青森県から鹿児島県にかけての野外調査で採集した地衣標本及び北海道稚咲内で得られた標本計約1050点を分類学的に検討した結果，16種の固着地衣が日本新産種であることが判明したので報告する．このうち，***Anisomeridium, Chrysothrix, Cliostomum, Maronea, Pachyphiale, Scoliciosporum, Strangospora*** は日本新産属である．報告した種は何れも北半球の温帯から寒帯に広く分布するが，***Anisomeridium nyssaegenum, Enterographa zonata, Opegrapha gyrocarpa, Pachyphiale carneola*** は何れも日陰で湿った環境を好んで生育する．地衣類は一般に日当たりと風通しの良い環境を好んで生育するが，いわゆる陰地を好んで生育する種群がイワノリ属やハイイロキノリ属以外にも存在し，どの種類も共生藻に ***Trentepohlia*** を含むことが確認された事は注目される．主な資料収集場所は，稚咲内（北海道），縫度石山，八甲田山（青森県），立山（富山県），小田原（神奈川県），高野山（和歌山県），蒜山（岡山県），霧島高原，屋久島（鹿児島県）である．以下に報告した種類を簡単に説明する．

Anisomeridium nyssaegenum **(Ellis & Everh.) R. C. Harris**（ゴマゴケモドキ，新称）

Anisomeridium（ゴマゴケモドキ属，新称）は被子器を有し，広義のアオバゴケ科に属すると考えられるが，分類学上の位置ははっきりしない．地衣体は痂状，灰緑色，薄膜状であるが連続する．共生藻は ***Trentepohlia***．被子器は半球状で孔口近くまで薄い地衣体で被われ **involucrellum** は発達する（**Fig. 1a**）．子嚢は8個の胞子を有しその配列は **biseriate**，胞子は無色2室，中央よりやや片寄ったところに隔壁ができるのが特徴である（**Fig. 1c**）．粉子器は普通にみられ，径 **0.1mm** 内外で頂部からジェラチン質で被われた桿状の大分生子（**Fig. 1b**）をつきだしたものが多い．本種は欧州や北米に広く分布する種類であるが，これまでに日本からの報告はない．今回の調査中，岡山県蒜山高原のお寺の参道わきで一度だけ生育が確認されただけである．生育地はソメイヨシノの株もとで雑草に被われてやや日陰になる部分であった．地衣体：**K－，C－，P－，UV－**，地衣成分は検出されない．

Arthonia spadicea **Leight.**（クリイロホシゴケ，新称）

オオシラビソ，ハンノキ，ミズナラなどの樹皮に着生する．地衣体（**Fig. 2a**）は肌色－帯緑灰色で薄く分化しない．共生藻は ***Trentepohlia***．裸子器は類円形，径 **1.0mm**，褐色－黒褐色でほとんど平坦，子嚢層は褐色，**K＋**淡紫色．胞子は無色，不同2室，**10-11×4μm**．これまでに津軽半

島と八甲田山だけで採集されている．地衣体：K−，C−，P−，UV−，地衣成分は検出されない．

Arthonia vinosa Leight.（キゾメホシゴケ，新称）

クリイロホシゴケに似ているが地衣体表面，特に裸子器の周辺部に黄色色素を持ち，胞子がやや大きい（15-17×6-7μm）の容易に区別できる．生育地が確認されているのは稚咲内のアオモリトドマツ着生だけである．反応，地衣体・髄層：K−，C−，KC−，P−．

Chrysothrix candelaris（L.）J. R. Laundon（コヌカゴケ，新称）

Chrysothrix（コヌカゴケ属，新称）は微細な黄色（K−）で顆粒状の地衣体（径　16-40μm）を有し外見状はロウソクゴケモドキ（*Candelariella vittelina*）に酷似する．しかし，顆粒の大きさは常に40μm以下で地衣体は分化せず，子器を生じることがないので区別できる．本種は南極大陸を除く世界中に広く分布し，国内でも神奈川県以南屋久島までの4箇所で各種の樹皮上や木製の建造物の上に生育することが確認された．本種はロウソクゴケモドキと混同されやすいが，今後日本各地から発見されるものと思われる．本種にはカリシンだけを含むものとカリシンとピナスツリン酸を同時に含む2つの化学的変異株の存在が知られている（Laundon 1981）．これまで採集された標本の内屋久島以外のものはすべて後者である．地衣体：K−，C−，P−，UV−．

Cliostomum griffithii（Sm.）Coppins（イボゴケモドキ，新称）

Cliostomum（イボゴケモドキ，新称）はイボゴケ科（Bacidiaceae）に属する．地衣体は顆粒状，淡灰色，共生藻は単細胞の緑藻．裸子器（Figs. 2b, 4）は径8 mm内外，盤は灰色で粉霜で被われ，周辺部は盤よりも淡色となる，ビアトラ型，果殻や子嚢下層は淡色，胞子は長楕円体，無色2室，11-13×3μm．胞子や裸子器の形状は*Catillaria*属に似ているが粉子器の外壁がK＋紫色になるので区別できる．日本産の標本は北海道稚咲内のトドマツ樹幹上のもの一点で，ササクレカラタチゴケの株もとを取り囲むようにして地衣体が発達していた．本種は子器が灰色から黒色まで変異に富むが，日本産の標本は淡灰色である．

地衣体：K＋黄色，C−，P±黄，UV±泥白色，アトラノリンとロクセリン酸を含む．

Enterograph zonata（Körb.）Källsten（イワエンテログラファ，新称）

本種はオーバーハングした岩石下部の日当たりの悪いところを好んで生育する．地衣体（Fig. 2c）は痂状，厚さ0.2mm以下，径4 cmほどの丸いコロニーを形成する，共生藻は*Trentepohlia*．表面は暗緑灰色−暗緑褐色，直径0.2mm前後の粉芽をつける．粉芽は融合せず，新しくできたものは表面に赤紫色の色素を持つ．髄層は白色，蓚酸石灰の結晶を含む．日本産の標本は全て無子器であるが地衣体の形状，地衣成分（コンフルエント酸，2'-O-メチルミクロフィリニック酸），生育場所とも欧州産の標本とよく一致する．今回の調査中では富山県立山の称名坂で一度だけ採集された．地衣体：K−，C−，P−，UV−．

Lopadium disciforme（Flot.）Kullh.（ツブウスゴケ，新称）

ツブウスゴケ（Fig. 2d）本種は樹皮上または生葉上に生じる．地衣体は緑色−帯緑褐色，痂状−顆粒状，共生藻は緑藻．裸子器は0.7mm内外，黒褐色で基部でくびれる．果殻は灰褐色，parathecium は褐色，amphithecium は淡褐色．胞子は子嚢の中に1個生じ，無色多室．本種はこれまでに本州中部以北で採集されており，明らかに北方系の種類と考えられる．広義の*Lopadium*属は最近のHafellner等の研究（1982）により*Brigantiaea*（サビイボゴケ属），*Lopadium*（ウスゴケ属，新称），*Letroutia*（ムニンサビイボゴケ属，新称）に区別されている．狭義の*Lopadium*属としては*L. diciforme*だけが日本に産し，Kurokawa and Kashiwadani（1977）が日本から報告した*L. pezizoideum*は再検討の結果，本種と同定された．地衣体：K−，C−，P−，UV−，地衣成分は検出されない．

Maronea constans（Nyl.）Hepp（アオチャゴケ，新称）

Maronea（マロネア属，新称）の裸子器はレカノラ型でチャシブゴケに酷似しているが，子嚢に無色単室の小さい胞子（4-5×2-3　μm）を多数（多くは100個以上）生じるので区別される．本

種の地衣体（Fig. 2e）は緑色で顆粒状に盛り上がり，径直径0.8cmの類円形に広がる．裸子器は径0.8mm内，盤は赤褐色，周囲は完全で灰緑色で果托には小型の（5-10μm）の炭酸カルシュウムの結晶を多数生じる．これまでに生育が確認された地点は岡山県蒜山高原だけである．道路沿いの日当たりの良いクリの樹皮上で発見された．地衣体：K−，C−，P−，UV−，

Opegrapha gyrocarpa Flot.（ヒカゲキゴウゴケ，新称）

オーバーハングした日当たりの悪い岩の下部に生育する．地衣体は痂状，平滑，緑褐色，下生菌糸は茶褐色−黒褐色．共生藻は *Trentepohlia*．白色で類円形の粉芽（径0.8mm以下，Fig. 2f）を持つ．裸子器はリレラ状または緩くギジ状に巻き，長さ1.3mm，巾0.8mmになる．果殻は黒色，胞子は長楕円形，無色で3室に分かれ，loculeは円筒形−立方形，16-19×5-6μm．地衣体：K−，C−，P−，UV＋（青白色）または−，シゾペルト酸（UV＋青白色）またはプソローム酸（P＋黄色，UV−）を含む．Tønsberg（1992）の研究によると，本種にはシゾペルト酸を含む変異株とジロフォール酸を含む変異株が報告されているが，日本産のものはシゾペルト酸を含むものの他に未検定物質を含むものが見つかった．今回の調査で青森県縫度石山と富山県立山で生育が確認された．

Opegrapha varia Pers.（ムツノキゴウゴケ，新称）

地衣体は樹皮生で非常に薄い，灰白色−灰緑色，共生藻は *Trentepohlia*．子器はリレラ状で単一（Fig. 2g），稀に枝分かれする，長さ1.3mm，巾0.3mm以下，盤は開くが粉霜はない，果殻は下部でせばまるが閉じない，全体に渡って炭化する，厚さ23-25μm，擬側糸は分枝する，子嚢下層は褐色，胞子は楕円形，横に5（稀4または6）の横の隔膜を持つ，各室は円柱形−立方形，若い胞子は透明，古いものは茶色に変わる，episporeあり，4-5 ×2μm．地衣体：K−，C−，P−，UV−，地衣成分は検出されない．本種は子器の外形がモジゴケ属によく似ているが果殻は地衣体から完全に裸出し，隔膜で隔てられる室は円柱状，擬側糸が分枝するなどの点で区別できる．*Opegrapha* の中でも本種の胞子は巾が5μmと広いことが特徴である．現時点では青森県縫度石山産の標本だけで生育が確認されているが，北日本には広く分布している可能性が高い．

Pachyphiale carneola（Ach.）Arnold（コウスゴケ，新称）

Pachyphiale（コウスゴケ属，新称）はサラゴケ科に属する固着地衣で，*Trentepohlia* 属の共生藻を持ち，子嚢中に多数（通常16個）の多室で無色の胞子を生じることで特徴づけられる．地衣体は樹皮上に生じ，痂状で微細な粒状，淡緑色．裸子器は淡褐色で非常に小さく（直径0.3mm以下）柔らかい．盤は凹み盤の周囲は連続する．子器（Fig. 3a）はレカノラ型であるが共生藻は子器の下部のみに存在する．果殻は発達し周辺部のみ茶褐色，内部は無色で厚さ30-40μm，胞子（Fig. 3b）は子嚢中に16個生じ，線状，隔壁は横に7-12本，47-54×3-4μm．地衣成分は検出されない．これまでに蒜山高原で一度採集されただけである．生育場所は欧州産の標本と同様，小川沿いの日当たりの悪いコナラの樹皮上である．目立たない種類であるので見過ごされている可能性が高いが，今回の調査旅行の際には他の生育地は確認できなかった．

Pachyphiale fagicola（Hepp）Zwackh（キタノコウスゴケ，新称）

地衣体は痂状，淡緑色，厚さ0.1mm．子器は淡褐色でコウスゴケのものに酷似するが胞子（Fig. 3c）は短く（23-29×3μm）で，隔壁も5-8本と少ない点で区別できる．本種は北方生で日当たりの良い樹皮上に生育するので（Purvis等1992），北海道では他の生育地が見つかる可能性が高い．

Porina mammillosa（Th. Fr.）Vainio（クロツブゴケ，新称）

地衣体は痂状，地上生，灰緑色で薄膜状，共生藻は *Trentepohlia*．被子器は径約0.4mm，黒色，被子器は径0.4mm以下．子嚢胞子は無色，紡錘形，隔室は横に3本，21-26×5μm．日本から報告されている他のホルトノキゴケ属（*Porina*）は生葉上に生じるが，今回見つかったものは，灌木の根元に蘚類と共に生育していた．

Scoliciosporum chlorococcum（Graewe ex Stenh.）

Vězda（エダゴケ，新称）

地衣体は痂状，緑色，かさぶた状で不規則に広がり基物からやや盛り上がる，共生藻は*Trentepohlia*．子器（Fig. 2h）は黒色で光沢があり，中凸，径0.3mm以下，子嚢下層は無色，側糸は分枝する．胞子（Fig. 5a）はムチ状，一端が細長く伸びる．無色，横に7-8本の隔膜がある，26-30×4-5 μm．本種は樹木の細い枝先上に生じる．北半球に広く分布する種類であるが，今回の調査で日本にも産する事が確認された．北海道から九州まで各地に広く分布すると考えられる．

Scoliciosporum umbrinum（Ach.）Arnold（シオゴケ，新称）

エダゴケに酷似するが胞子（Fig. 5b）が小型（18-24×2-3 μm）で隔壁が3-4本と少なく，子嚢中では常に螺旋状に固まって生じる点で区別できる．下北半島の海岸近くの岩上で採集した一標本が本種と同定されるが，この他の場所でも本種に酷似した地衣が散見された（基物を破壊する恐れがあるので採集はしなかった）．今後他の地域からも報告されるものと思われる．

Strangospora moriformis（Ach.）Stein.（チビゴケ，新称）

Stgrangospora（チビゴケ属，新称）はホウネンゴケ科に属する固着地衣で*Biatorella*属に近縁であるが子嚢の外側に粘液性の膜を形成せず，子嚢上部のapical domeがヨードで濃紫色に変わる点で異なる．本属の報告は日本からは始めてである．チビゴケの地衣体は痂状，灰緑色，不連続な小片となる，共生藻は緑藻．子器は黒褐色，径0.4mm以下，子嚢上層は青藍色，果殻は薄くほとんど発達しない，子嚢下層は無色，側糸は分枝する．胞子は子嚢中に多数生じる（通常100個程度），胞子は球状，単室，径3-4 μm．本種は北半球に広く分布し欧州の中部及び北部，北米から報告されている．今回の調査では立山弥陀が原の旧火口脇のアオモリトドマツ上で見つかった．